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NEWSLETTER OF THE LONDON CHAPTER
ONTARIO ARCHAEOLOGICAL SOCIETY

LONDON CHAPTER
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LOSS OF ARCHAEOLOGICAL SITES BY EROSION:
THE LAKE ERIE NORTH SHORE

Professor Robert Quigley of the University of Western Ontario Faculty of Engineering and Chapter member Dana Poulton commence the New Year on a sobering note. Their slide illustrated presentation will provide members with what may be a shocking revelation concerning the degree of archaeological resource destruction occurring along the Erie shoreline just south of us.

Meeting time is 8:00 PM on Thursday, January 10 at the Museum of Indian Archaeology. Hope to see you all there!

EXECUTIVE REPORT

Our newly acclaimed Chapter executive held their initial 1985 meeting at the Gibbs residence. There were congradulations and a special note of thanks to the Keron family for a most successful Chapter Christmas Party. At our December gathering , the membership voted unanimously to support the proposed $2.00 increase in Chapter dues.

Vice-president Dave Smith, who has been continuing research into the proposed Chapter spring bus trip, drafted the enclosed questionnaire in order to provide members with an opportunity to contribute their ideas to the design of what we hope will be our most popular tour to date. He and the rest of the executive have also been working on the final organization of our 1985 symposium. Details will be available next month.

Finally, Linda reported on her attendance at the second Ontario Hydro interest group review meeting. Once she has settled into the review process a report to the membership will be forthcoming.

SOCIAL REPORT

Dave and the rest of the executive are hoping for a good response to the enclosed questionnaire so that a succesful tour can be designed to specific membership interests. Your cooperation through a prompt return would be greatly appreciated. Results will be published in next month's issue.

The following are some upcoming meetings which may be of interest to Chapter members:

McMaster Symposium: Osteo-Archaeology
Hamilton, February 16, 1985

Canadian Archaeological Association: Annual Meeting
Winnipeg, April 26-28, 1985

Thursday Night Labs

Back by popular demand.....your chance to touch the dust of ages! When - 7:30 PM, starting January 17. Where - 55 Centre Street, London. An opportunity for adventure at no personal expense and with little chance of injury (except for those drinking the coffee). Be there!

Editor's Corner

With the arrival of a New Year full of promise, it seems only appropriate that KEWA make a fresh start with a word processed format. An upgraded Xerox machine will soon arrive which may make double sided printing more feasible. Considering the increasing size of contributed research articles this may well be a necessity in the near future!

As our membership has expanded over the years, an increased volume of papers have been submitted for publication by a greater variety of researchers. This issue is no exception to the trend. Archaeologists are beginning to appreciate the speed with which their works are made available to the public through the less formal medium of our newsletter. Their data and ideas are received by a wide audience of both avocational and professional archaeologists throughout Canada and the adjacent United States. Their papers are being cited in numerous research articles published elsewhere; and in addition, six KEWA articles/features were reprinted through other O.A.S. newsletters in 1984 alone!

Editing and producing our newsletter continues to be both a personal pleasure and a chore. However, lest we Chapter members forget, the KEWA newsletter we receive each month is always a team effort. Some of the more illustrious and anonymous members over the years have been: Betty Kirk, Kelly Edwards, Barb Gale, Mary Nowiski and even Deb Pihl and Ian Kenyon (typists); Ian and Tim Kenyon, Janie and Bill Fox (graphics/illustrations); and Ian Kenyon, Paul Lennox, Chris Ellis and Bill Fox (point type features). Tim Kenyon's **Nineteenth Century Notes** feature has proved extremely popular. Finally many long days and nights have been spent by the aforementioned typists and "volunteers" such as Neal Ferris, Christine Dodd, Peter Reid, Doug Hohnstein, Janie Fox, Paul Lennox, etc. in the copying, collating, stapling, envelope stuffing/sealing and stamping of each issue. The quality of our newsletter reflects their dedication!

Speaking of such things, this issue is dedicated to that little machine which holds the potential for tremendous time saving on the one hand, while offering the tremendous temptation to waste countless hours on the other.....zapped another alien! Consistent with our traditional scholarly tenor, the following articles address some scientific applications of micro-computers.

TWO EASY PIECES FOR THE MICROCOMPUTER

M.A. Latta

Within the past five years, microcomputers have progressed from curious toys to necessary household appliances, a process which will have impact on many aspects of our lives in the future. Not the least of these changes is the invasion of computer technology into many levels of archaeological analysis, for the amateur as well as the professional worker. This article offers two short but powerful statistical programs for the IBM-PC and compatibles; it then urges extended exchange of micro related archaeological information.

Until about twenty years ago, it was possible for the archaeologist to ignore all but the most basic statistics. Requiring vast numbers of repetitive and individually boring calculations, statistical analysis was an invitation to inaccuracy and its results were viewed with general doubt. The fact that computers were capable of carrying out such operations with reasonable speed and accuracy did not affect most archaeologists, since access to computers was limited to persons affiliated with academic or research

institutions who possed the necessary skill and determination to wade through the incredibly dense procedural miasma which surrounds such facilities. It was quicker and easier to draw things on cards and add them up by hand.

In the 1960s, the "New Archaeology" discovered the computer. Perhaps the newest aspect of the New Archaeology was its jargon borrowed, sometimes with dubious accuracy, from the computer world: we all began to speak of paradigms, of recursive functions, of statistics. Books such as Doran and Hodson's Mathematics and Computers in Archaeology (1975), trembling on the brink of comprehensibility, assured the archaeologist that the computer would provide new levels of archaeological truth. Movies and television showed that all one needed to do was to "feed in" information, usually a casual remark through a microphone, and wait for a solution (which usually came back through the same microphone...)

In fact, the introduction of computer techniques has been of the greatest importance to archaeology, but in directions which were not apparent at the outset. To my knowledge, no new prehistoric traditions have emerged from the computer analysis of archaeological data. Our basic interpretative frameworks are established by techniques which rely upon criteria such as stratigraphy, ecology and gross technological traditions; in their basic distinctions, these data do not require computerized confirmation. The computer made possible the analysis of other sorts of information, however. The archaeological world was swept into an orgy of measuring, recording, refining calipers and remeasuring. The consequent explosion of information has yet to be absorbed; archaeology suffers from a sort of numerical constipation.

It didn't help that the experts failed to agree on the use of computer procedures. Classic studies such as Binford and Binford's analysis of functional variability in Paleolithic tools (1966) found that their computer techniques were more powerful than their data, and this has made archaeologists very cautious about the use of statistics.

Perhaps the fairest observation on the subject is the old computer science warning -- GIGO: garbage in, garbage out. You may get very reliable numbers but you can't get truth from a computer; the most you can hope for is a reasonable probability. One unfortunate effect of this state of insecurity is a hesitation on the part of archaeologists to publicize their methods. If one offers general conclusions and observes that these are supported by computer analysis, one avoids nasty criticism. Thus, despite the numerical data blockage mentioned above, archaeology in the computer age appears more reliant upon untestable generalizations that was true back in the days of the "Old Archaeology".

Into this state of numinous confusion, the microcomputer dropped like a bomb. Suddenly every archaeologist had access to enough computing power to carry on sophisticated numerical analysis if he knew how to use it. Unfortunately, though the computer industry offers joy-sticks, mice and similar technical aids, that two-way microphone is still unavailable for data input. To communicate with his micro, the archaeologist has two choices: either buy packaged programs, or learn to program for himself. Most of us opt for the former. Many sorts of computer uses, notably graphics and word processing, involve complicated system procedures which are beyond the skill of the amateur hacker. A huge industry, much of it located in the southern United States, churns out program packages designed to satisfy any need. As in any high-pressure industry, there is a great deal of repetition and competition tends to focus

on advertising and sales. It is difficult for the prospective user to judge the relative merits of these -- frequently expensive -- packages and design flaws are unfortunately far too common. Any commercial program is regularly updated; it may not be possible to find anyone who knows anything about the program which you bought two or more years ago. Caveat emptor.

Given this situation, it is wise to look at the alternative of doing one's own programming. It has several merits: it is cheap, it is convenient, and if something goes wrong you are the person best equipped to fix it. Most micros use some variation of the language BASIC. Unfortunately different computers use slightly different versions of this language, but fortunately the terms which vary least, in my experience, are those designed for mathematical computations.

Unlike word processing or graphics, statistical programs can be short and simple. The size and complexity of commercial programs is generally due to a tendency to pack a wide variety of procedures into one program and by a desire for nifty-looking output. If one wants one procedure only, and if one is satisfied with less elaborate output, then statistical programs can easily be written for the micro.

As an example, here are two very short and simple programs which pack a lot of statistical power. They are written in BASICA for the IBM-PC and compatibles; minor changes may be necessary for your particular system. The first program computes the average and standard deviation of a series of numbers. The numbers can be sherd sizes, chert flake weights, C-14 counts, anything; the procedure is the same.

The second program calculates the correlation coefficient (Pearson's r) for a series of paired measurements -- collar height vs lip thickness, for example, or length vs width of projectile points. In this case, the program can easily be altered to produce a graph which plots each pair of points.

```
10 REM Program to calculate means and standard deviations
20 FOR I = 1 TO 1000
30 READ X
40 IF X = 99 THEN 90
50 N = N + 1
60 SA = SA + X
70 A2 = A2 + X^2
80 NEXT I
90 MA = SA/N
100 SD = SQR((A2-SA^2/N)/(N-1))
105 PRINT "SAMPLE SIZE IS       ",N
110 PRINT "MEAN VALUE IS        ",MA
120 PRINT "STD DEVIATION IS     ",SD
130 DATA statements
140        -
150        -
160        -
170 DATA 99
1000 END
```

Program Listing 1

```
10 REM Program to calculate Pearson's r
20 FOR I = 1 TO 1000
30 READ X,Y
40 IF X = 99 THEN 120
50 N = N + 1
60 S1 = S1 + X
70 S2 = S2 + Y
80 S3 = S3 + (X*Y)
90 X2 = X2 + X^2
100 Y2 = Y2 + Y^2
110 NEXT I
120 R = (S3-(S1*S2)/N)/SQR((X2-((S1^2)/N))*(Y2-((S2^2)/N)))
130 PRINT "SAMPLE SIZE = ",N
140 PRINT "r = ",R
150 DATA statements
160        -
170        -
180        -
190 DATA 99,99
1000 END
```

Program Listing 2

Both of these programs employ conventions which can easily be changed at the user's discretion. They are set to handle up to 1000 numbers, in the first case, or pairs

of numbers, in the second. If you wish to deal with a larger sample, then change all references to 1000 to whatever size you wish, keeping in mind the size limits of your computer. In both cases, the number "99" is used as a signal to the program that the data is finished. If 99 is likely to occur in your data, then change these references to some other number -- perhaps a very large number -- which will not occur. Note that your last data statement must then have that number, as in the examples above.

If you wish, these programs may both be changed to accept typed input directly from your console, rather than reading it from prepared DATA statements. Change READ to INPUT in each case. You may also wish to print the results on a printer rather than having them displayed on your screen:change PRINT to LPRINT.

These simple programs are intended to stimulate an information-sharing network on microcomputer applications in archaeology. Do you have better programs for these calculations, or for other statistical problems? What sort of programs do you need? What special expertise or resources do you have to offer to the archaeological user? By pooling our resources, we will be able to ensure that the microcomputer revolution contributes its full potential to the growth of Ontario archaeology.

REFERENCES CITED

Binford, L.R. & S.R. Binford
1966 A Preliminary Analysis of Functional Variability in the Mousterian of Levallois Facies. American Anthropologist, Vol. 68, pp. 238-295.

Doran, J.E. & F.R. Hodson
1975 Mathematics and Computers in Archaeology. Harvard University Press, Cambridge.

YOU, YOUR MICROCOMPUTER, AND BASIC DECAY

Peter Reid

Since the pioneering efforts twenty years ago of Renfrew, Dixon, and Cann (1966, 1968) the use of distance-decay models to describe possible trade activities suggested by the archaeological record has enjoyed a considerable vogue. (See Hodder, 1974, and Hodder and Orton, 1976, for reviews of some of this work. See Renfrew, 1977, and Bettinger, 1982, for further examples. See also Taylor, 1971, for a review of the geographical literature from which archaeologists have cribbed much of these analyses.) I have made modest contributions to this literature (Reid, 1977, 1978), and am currently working on a project to test the usefulness of such analyses, using chipped-stone assemblages from the Lower Great Lakes region.

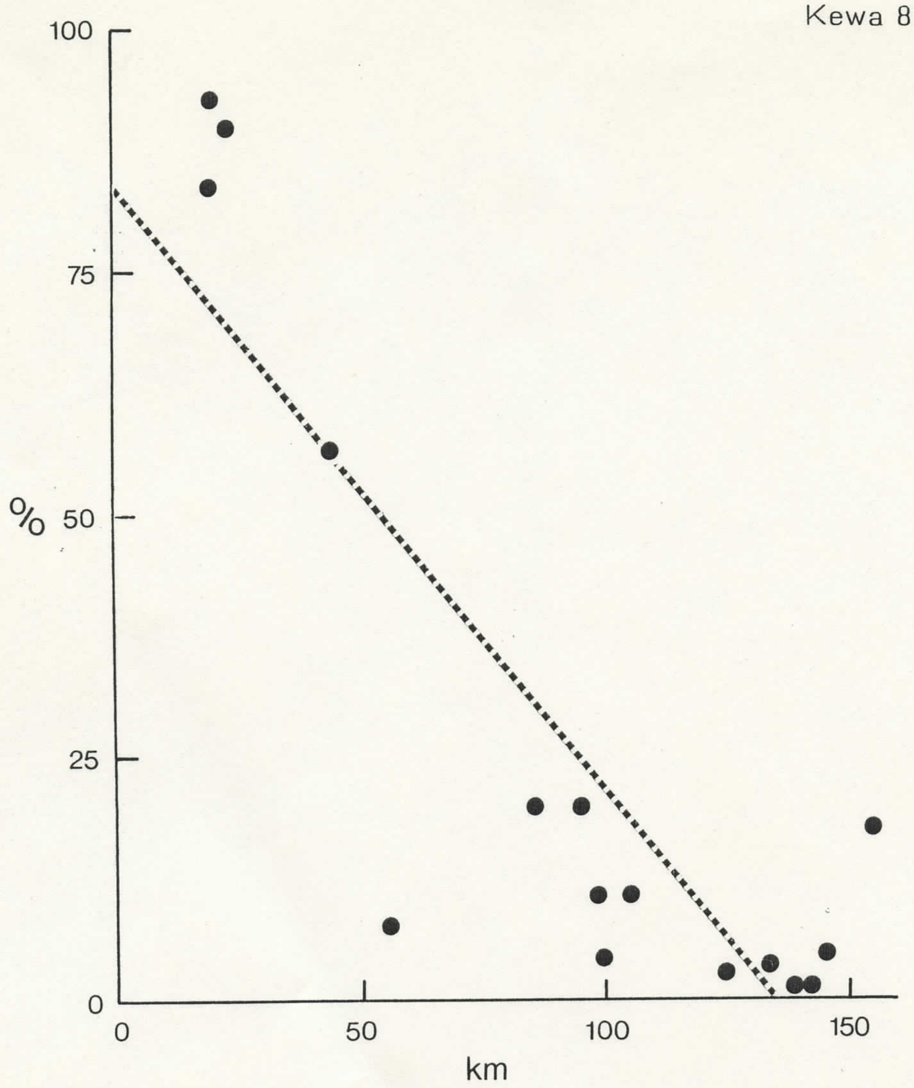


Figure 1: Percentage vs Distance (km) for Kettle Point Chert at 16 Archaic Sites in Southwestern Ontario (% data from Janusas, 1983).

Basically, it is assumed that "interaction" (let us say, the distribution of some kind of artifact through trade) "decays" (becomes less frequent, involves smaller quantities) the further you get from the source of the goods. In the simplest model, interaction depends on distance only. Let us describe a number of assemblages of chert artifacts and debitage in terms of 1) the percentage which chert from a particular source makes up of the whole assemblage (a crude, but often-used, measure of "interaction"), and 2) the distance of the site of the assemblage from the chert source (this could be miles, kilometers, amount of travel time, amount of difficulty, monetary cost, etc). This information can be displayed on a "scattergram", such as Figure 1, which compares, for 16 Archaic sites in southwestern Ontario, distance in kilometers against percentages (Janusas, 1983: 98) of Kettle Point chert, a high-quality material outcropping on the shore of Lake Huron near Port Franks, Ontario, and much used for chipped-stone artifacts in southwestern Ontario. The scattered points form a sort of linear pattern and can be "fit" by the diagonal line shown on Figure 1. This "regression" line is represented

by the equation $y = 84 - 61x^1$. Straight lines with such simple equations would "best fit" our scattergrams if the "linear model" for distance decay were the most appropriate: greater distance alone causes the falling off of the interaction. How appropriate is this model in this particular case? Calculating Pearson's **r** (the most commonly used correlation coefficient, Blalock, 1972: 380) gives us an idea of this : -.86. Not bad, for archaeological data. But remember that this means (Blalock, 1972:392): $(-.86)^2$, or .74, is the proportion of the variability of the dependant variable (chert-type percentages) which the independant variable (distance) accounts for. Or, one-quarter of the distribution of the chert percentages is caused by factors other than simple distance from the source. (Actually, this result is still pretty good for archaeological data.)

MODEL	EQUATION	POSSIBLE SIGNIFICANCE	b	m	r	r^2
Linear	$y = a - bx$	Direct procurement by groups operating independantly within a supply-zone	-.61	1	-.86	.74
Hyperbolic	$y = a - bx^{-1}$	Intermediate between direct procurement and down-the-line trade partner reciprocity	2054.0	-1	.96	.92
Square Root Exponential	$\log y = a - bx^{.5}$	Down-the-line trade partner reciprocity low value goods from small-scale production centres	-.19	0.5	-.83	.68
Exponential	$\log y = a - bx^1$	Down-the-line trade-partner reciprocity or less frequent, more costly consumer moves	-.01	1	-.82	.66
Normal	$\log y = a - bx^2$	Several trade route mechanisms operating at once, yielding a random pattern of distribution or quite costly and infrequent consumer moves	0.0	2	-.76	.58
Pareto	$\log y = a - b \log x$	Very infrequent moves (marriage, migration). Probably inapplicable to trade behaviour.	-1.7	1	-.82	.68
Log-normal	$\log y = a - b \log x^2$	As above	-.48	2	-.83	.68
Logit	$\log(y/(100-y)) = a - bx^1$	Raw material class (chert for example) represented by two types, for two sources such that the proportion of one decreases and that of the other increases (at exponential rates) as sites get further from one source and closer to the other. So far used only under the assumption of down-the-line trade partner reciprocity.	-.02	1	-.86	.74

The "best-fitting" model seems to be the "hyperbolic" with its correlation coefficient of .96. This result is suspect, however, due to the peculiar way in which this model distorts the data. (On any scattergrams transformed by this model, all of the points would be jammed into a line very close to, and almost parallel with, the y-axis.) The next "best-fitting" models are the linear and the "logit", which suggests that the Archaic Indians were, essentially, directly procuring their chert from two sources: Kettle Point, and, probably, local secondary deposits of Onondaga chert.

Table 1: Selected Models of Distance Decay Applied to the Distribution of Kettle Point Chert at 16 Archaic sites in Southwestern Ontario.

The above-quoted equation is a member of a more general family of regression equations for which the formula is $y = a + bx^m$. Hodder (1974: 179) shows that the slope (b) is greater (steeper) for bulky goods, sources with low outputs, and/or costly and inefficient trade and transportation networks. The exponent (m) also varies in response to past human behaviour (Hodder, 1974:179-183): values between 0.1 and 0.6 go with trade in low-value goods and/or small-scale production centres; higher values (0.9 to 2.5) go with higher-value goods and/or centres with large production outputs. It is also suggested (Hodder, 1974:174) that larger exponents would be found in systems of trade or other kinds of interaction (migration, out-marriage, etc.) where individual "trips" are costly and/or infrequent.

Following Taylor (1971), Renfrew (1977) and others, archaeologists have achieved useful results by further manipulating the general regression equation: in some cases, the logarithm of y is substituted for y, and, in others, log(x) is substituted and used with log(y). There is also the suggestion that, in cases where two sources supply most of the chert used at a series of sites, the "logit" model, where log(y/(100-y)) is substituted for y, most faithfully models the prehistoric chert procurement behaviour. Thus, when confronted with scattergrams such as that in Figure 1 (which are not likely to be as neat as this one), the archaeologists have a number of regression models to play with. Eight such models, their possible significance in terms of past trade behaviour, and the results obtained when they were applied to the Archaic Kettle Point data, are shown on Table 1.

Testing the percentage distribution through space of a particular artifact type against various mathematical models of this sort would be a tedious and time-consuming procedure. The formula for deriving the slope of a line in the simplest, linear, model is:

$$b = \frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{N\Sigma X^2 - (\Sigma X)^2}$$

That for the correlation coefficient is:

$$r = \frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{[N\Sigma X^2 - (\Sigma X)^2][N\Sigma Y^2 - (\Sigma Y)^2]}}$$

With pre-1965 archaeological equipment (ball-point, scratch paper, your noggin, and half-remembered high school algebra), it would take the better part of a working week to produce the information on Table 1 for a sample of merely sixteen assemblages. With a reasonably expensive mid-'70's vintage pocket-calculator, you could do it in an afternoon, providing copious quantities of tea and/or black coffee were available. But, thanks to the microcomputer, your raw data can be keyed into a neat program in five to thirty minutes (depending on how big your sample is) and, running your fingers swiftly and deftly over the keyboard, you can summon a print-out of this data in less than five minutes. Such a program has been prepared for a Radio Shack TRS-80 Model III, and is appended to this article.

REFERENCES CITED

Bettinger, Robert L.
1982 Aboriginal Exchange and Territoriality in Owens Valley, California. In Contexts for Prehistoric Exchange, edited by J.E. Ericson and T.K. Earle, pp. 103-127. Academic Press, New York.

Blalock, Hubert M. Jr.
1972 Social Statistics. McGraw-Hill, New York.

Hodder, Ian
1974 Regression Analysis of Some Trade and Marketing Patterns. World Archaeology, Vol. 6, pp. 172-189.

Hodder, Ian & Clive Orton
1976 Spatial Analysis in Archaeology. Cambridge University Press, Cambridge.

Janusas, Scarlett E.
1983 A Petrological Analysis of Kettle Point Chert and its Spatial and Temporal Distribution in Regional Prehistory. M.A. thesis, Trent University.

Reid, Peter
1977 An Analysis of Trade Mechanisms in European Prehistory. Ph.D dissertation, Department of Anthropology, SUNY at Buffalo.

1978 Regression Curves and the Description of Certain Instances of Prehistoric European Trade. MS on file, Department of Sociology and Anthropology, University of Windsor.

Renfrew, Colin
1977 Alternative Models for Exchange and Spatial Distribution. In Exchange Systems in Prehistory, edited by T.K. Earle and J.E. Ericson, pp. 71-90. Academic Press, New York.

Renfrew, Colin, J.E. Dixon & J.R. Cann
1966 Obsidian and Early Culture Contact in the Near East. Proceedings of the Prehistoric Society, Vol. 32, pp. 30-72.

1968 Further Analysis of Near Eastern Obsidian. Proceedings of the Prehistoric Society, Vol. 34, pp. 319-331.

Taylor, Peter J.
1971 Distance Transformation and Distance Decay Functions. Geographical Analysis, Vol. 3, pp. 221-238.

THE WALLS THAT WOULDN'T BE STRAIGHT

Ian Kenyon

Over the past 4 years I have personally assisted in mapping something like 20,000 post moulds, fortunately I have had some good times as well. One major stint of this occurred at the late but unlamented Glen Meyer Calvert site where some 7,000 post moulds were mapped, almost all by the commonly used technique of triangulation. One notable property of Glen Meyer structures are their straight walls. When we took the first readings back to the office for plotting, the walls just wouldn't be straight, yet we knew they were. Fortunately it was not too late to redo the work, but obviously I had goofed -- What had gone wrong?

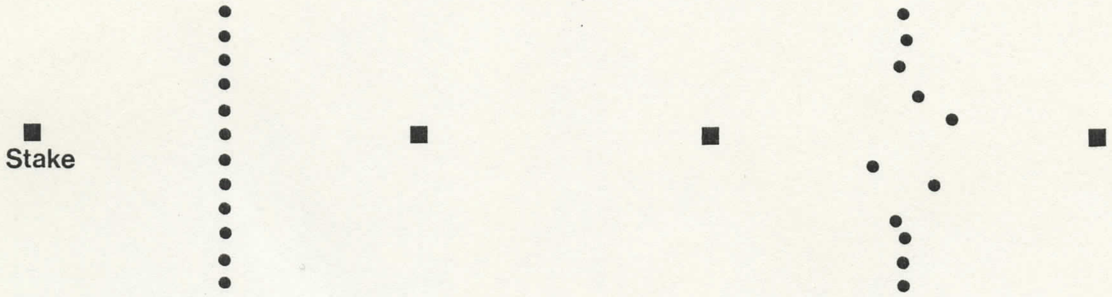


Figure 1: Hypothetical House Wall As Found (left) and As Plotted (right).

It didn't take long to find the answer. The badly plotted posts occurred near the imaginary baseline joining the two stakes used for triangulation. My mistake was in failing to heed the warning of introductory archaeological methods books: triangulation is not a reliable mapping technique when the tapes cross at either very acute or very obtuse angles, for with these extreme angles small errors in field measurement can be magnified into large plotting errors. And obviously posts near the baseline are measured with tapes positioned at obtuse angles. The standard field method texts indicated that triangulation was most reliable when the tapes crossed at right angles, but at what angle are tapes too acute or two obtuse for reasonably accurate measurements? On this point the field methods books were silent.

Here is where a computer helped to clarify the problem, through the use of a "quick-and-dirty" randomization program. This involved a hypothetical area of 10 by 10 meters centred on a 5 meter square. At grid intervals of 10cm, the two triangulation distances were calculated. A small "random" error was added or subtracted to each measurement, for such small errors are an inevitable component of any real-world measurement. Then the difference between the horizontal position of the "expected" or actual measurement and the "observed" (i.e. with attached random error) was calculated. For the centre of the square the difference between the position of the expected and observed locations was only slightly greater than the random error term. Yet in the vicinity of the base line random errors of only 1cm could translate into plotting errors of 10cm -- clearly unacceptable.

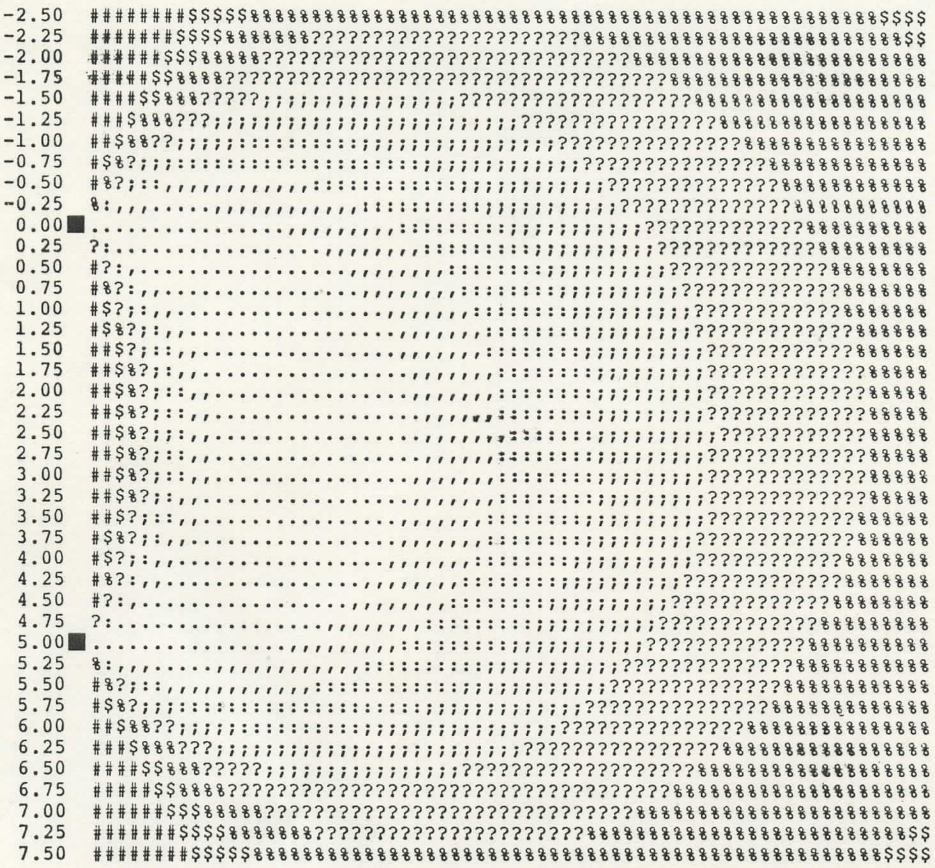


Figure 2: Computer Produced Map of Tape Angles (Sine). The denser the symbol the more extreme the angle and the measurement error. Scale in meters with measuring stakes placed at 0 and 5 meters.

Now, the plotting errors found through this randomization exercise are directly related to the angle at which the tapes cross. A computer produced map of these angles (or more properly the sine of these angles) is given in figure 2. The "safe zone" for measurement has a PacMan-like distribution with an evident "danger zone" at its mouth. Within the five-meter square the "danger zone" occurs in a roughly triangular area along the base line. Specifically, this danger zone can be defined as a triangle with its base along the line connecting the two measuring stakes and a height of roughly 50cm, or about 10% of the base line distance. More generally this **"10% rule"** can be applied to squares of other sizes (for example a "danger zone" 1m in height for 10-meter squares). Post moulds and features falling within this triangular "danger zone" should obviously be measured from another pair of stakes.

If nothing else, the problem of the "Walls that wouldn't be straight" gave me something to think about when taping in those post moulds, those endless post moulds.....

STATISTICAL TEXTBOOKS WITH COMPUTER PROGRAMS: A SHORT BIBLIOGRAPHY

Ian Kenyon

INTRODUCTION

Despite the increasing use of statistics and computer-use in archaeology, there are still no texts that simultaneously cover quantitative methods and appropriate computer programs. Fortunately, there is now a variety of books in both the social and natural sciences that describe basic and multivariate statistics as well as such topics as cluster analysis and spatial analysis. Most of these books have program listings in FORTRAN, although at least two have BASIC programs. The annotated bibliography that follows lists some such texts; it is not intended to be complete.

BASIC

BASIC is the computer language that comes with most home computers. Although excellent for writing short programs it is not very good for the longer programs required for multivariate statistics.

Orloci, Laszlo
    1978 Multivariate Analysis in Vegetation Research. W. Junk, The Hague. (2nd edition).

(Orloci presents a wide range of advanced programs for plant ecologists. Despite this focus, many of the techniques can be used by archaeologists, who, like the ecologists, are concerned with classification; further, the ecologists' "gradient analysis" is much the same as the archaeologists' "seriation". Programs include those for factor and principal components analysis as well as cluster analysis. There is a useful section on distance measures. Unfortunately the programs can not be used "as is" on most home computers for Orloci uses an advanced form of BASIC that includes the valuable MAT command, not usually a part of the shoddy and out-dated form of BASIC available for most home computers.)

Scalzo, Frank & Rowland Hughes
    1975 Elementary Computer-Assisted Statistics. Petrocelli/Charter, New York.

(An introduction to basic statistics accompanied by short programs for computing means, standard deviations, confidence limits, t-tests, F-ratios, chi-squares and linear regressions.)

FORTRAN

Since the 1950's FORTRAN has been the preferred computer language for statistical programming, and consequently there are many excellent books. Although FORTRAN is widely available for many home computers, the particular version may be different from that used in some of the books below. Nowadays, FORTRAN is considered to be an old-fashioned language and newer languages have been developed that are superior for statistical programming. Among these newer languages are APL, ideal for the matrix manipulation so necessary in multivariate statistics, and Pascal, with its emphasis on modular programming structure. Unfortunately, I am not aware of any statistical programming books using either APL or Pascal. In any case APL is not easily obtained for many home computers, perhaps because of its unorthodox character set, although Pascal is available for many systems.

Anderberg, Michael R.
1973 Cluster Analysis for Applications.
Academic Press, New York.

(The are a number of useful guides to cluster analysis including Sneath and Sokal's Numerical Taxonomy [1973], a reworking of their 1963 classic; Brian Everitt's readable Cluster Analysis [1974]; and A.D. Gordon's up-to-date Classification [1980]. Anderberg's excellent book covers much the same ground as these texts, but in addition it includes an appendix containing a wide range of computer programs for both hierarchical and partitioning [k-means] methods of cluster analysis.)

Blackith, R.E. & R.A. Reyment
1971 Multivariate Morphometrics.
Academic Press, New York.

(A coverage of standard multivariate techniques such as factor analysis and discriminant analysis using biological examples. Despite the book's length the chapters are written in a non-technical manner, rare in texts on multivariate analysis.)

Cooley, William W. & Paul Lohnes
1971 Multivariate Data Analysis.
John Wiley & Sons, New York.

(This text covers such standard multivariate techniques as factor and principal component analysis, canonical correlation, discriminant analysis and multiple correlation and partial correlation. A personal favourite.)

Davis, John C.
1973 Statistics and Data Analysis in Geology
John Wiley & Sons, New York.

(Geologists with their concern for classification and spatial analysis have adapted and developed many techniques of use for archaeologists. Davis' book is nicely organized, starting with an introduction to FORTRAN, then to a section on basic statistics, and finally to more advanced methods, including a lengthy section on map analysis, featuring trend surface, double fourier and moving averages. This book covers much the same territory as Mather's two texts although somewhat less comprehensive.)

Mather, Paul M.
1976a Computers in Geography: A Practical Approach.
Basil Blackwell, Oxford.

(A short book that serves as an introduction to both FORTRAN and basic geographical statistics. Included are programs for correlation and regression, nearest-neighbour analysis and linear programming.)

Mather, Paul M.
1976b Computational Methods of Multivariate Analysis in Physical Geography. John Wiley & Sons, London.

(An advanced book that assumes prior knowledge of FORTRAN and basic statistics, perhaps as gained from Mather, 1976a. This comprehensive book contains a wide range of programs including factor analysis, trend surface, several types of multidimensional scaling, discriminant analysis and cluster analysis.)

Sokal, Robert R. & F. James Rohlf
1969 Biometry: The Principles and Practice of Statistics in Biological Research. W. H. Freeman, San Francisco.

(This book is notable for its good coverage of basic univariate and bivariate statistics, covering many non-parametric techniques ignored in many such introductory works. Despite its length it is easy to use, and the appendix contains FORTRAN listings for all of the statistics described in the text. A personal favourite.)

Späth, Helmuth
1980 Cluster Analysis Algorithms for Data Reduction and Classification of Objects. Ellis Horwood, Chichester.

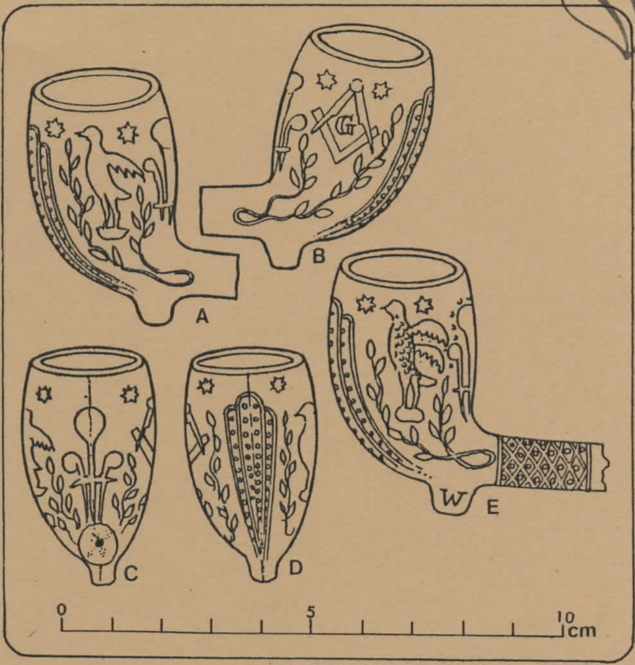
(This book represents something of a continental approach to cluster analysis emphasizing partitioning or k-means techniques rather than the hierarchical techniques often favoured by North Americans. The section on partitioning techniques, which forms the bulk of the book, is organized along tutorial-like lines, with short, heuristic programs being introduced first, followed by increasingly more complex and more useful procedures. The short section on hierachical clustering is not nearly so complete as Anderberg's.)

Veldman, Donald J.
1967 Fortran Programming for the Behavioral Sciences. Holt, Rinehart and Winston, New York.

(Covers much the same ground as the Cooley and Lohnes book.)

NINETEENTH CENTURY NOTES

MASONIC TOBACCO PIPES Thomas Kenyon



Published in 1900, The History of Freemasonry in Canada by J. Ross Robertson notes that Freemasonry was introduced to Canada in 1749. In this voluminous work a Masonic map of all Craft Lodges and Provincial Grand Lodges of England and Ireland lists and locates 29 in Upper Canada (1822-40) and some 90 in Canada West (1841-58). Masonic designs on clay tobacco pipe bowls, although not usually common, appear in varying quantities on 19th century sites in Ontario. The designs on the Masonic pipes are usually like the line drawings shown to the right (A to E). Although the basic motifs are standardized, there are numerous variations, suggesting that the pipes were made by a number of manufacturers. Some examples of these differences are: the standing bird with one outstretched wing (A) and bird with two wings with a nodule-covered body (E); the "Prince of Wales Feather" design on the the back of the bowl varies from crude to well defined (C). Generally, 19th century sites on the Lower Grand River yield a few fragments of Masonic pipe bowls. An exception is the Dockstater Inn site (c. 1825-55) located near York, where, of the 348 pipe bowl fragments recovered, 65 or 19% displayed Masonic motifs.

A recent excavation by Paul Lennox (M.T.C.) on the c. 1860 E.C. Row Expressway site (AbHs-7), located near Windsor, revealed an unusual Masonic white clay pipe with the letters GISCLON A LILLE impressed on the stem. At Montereau-faut-Yonne, 45 miles east of Paris, sometime in the first part of the 19th century, a pipe factory was started by one Gisclon. It was continued by his son-in-law Dutel who by 1859 has taken over the business. The factory was destroyed by fire in 1895. **Illustration 1:** The left side of the bowl displays a selection of "Masonic working tools" - a square and compass and, at the bottom, a ruler - "the 24 inch gauge", and in the background a crossed gavel and chisel. Above this a part of a wreath of acacia leaves and wheat, below in relief letters "FRATERNITE", on the stem, enclosed in an oval, the number 88 (probably the catalogue number of this pipe design). **Illustration 2:** On the right of the bowl is "Solomon's Temple with its 4 great pillars and 5 steps, on the right side of the temple, Jacob's ladder, and on the left 2 chain links with a hand". Above the temple are lines radiating from an eye and a sprinkling of stars -- all good Masonic symbols. Below in relief is the word "AMITIE". J.M. Hamill, Librarian and Curator of the Library and Museum of the United Grand Lodge of England, who examined drawings of the Gisclon pipe, notes that "...the designs on the right side (Temple etc.) and the arrangements of the tools on the left side are standard Masonic arrangements which appear on French (and Continental) aprons, certificates, engravings, pottery and glass."

Drawings Actual Size

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